Patterns of financial change in the OECD area

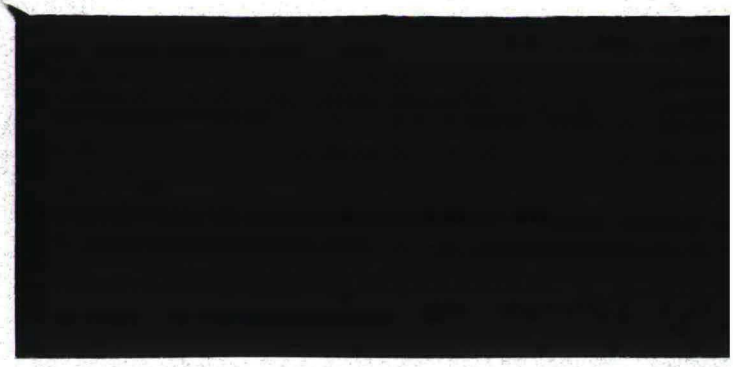
van Gemert, H.G.; Gruijters, A.P.D.

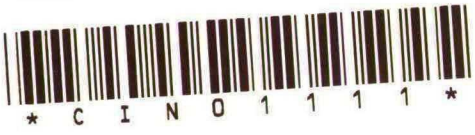
Publication date:
1994

Document Version
Publisher's PDF, also known as Version of record

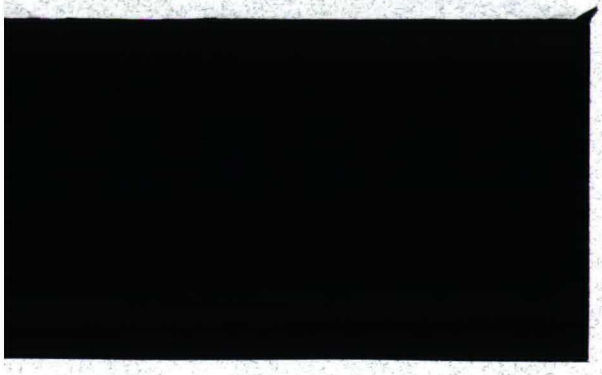
Faculty of Economics

research memorandum





Tilburg University



PATTERNS OF FINANCIAL CHANGE IN THE OECD AREA

Henk van Gemert & Noud Gruijters

Research Memorandum FEW 641

Communicated by Prof.dr. J.J. Sijben

Patterns of Financial Change in the OECD area

Henk van Gemert & Noud Gruijters*

February 1994

Abstract

This paper measures the nature and degree of global financial change by studying interest rate differentials among OECD countries. First, a simple portfolio model illuminates the various determinants of international capital mobility. The framework is used to deduce the characteristics of three fundamentally different but analytically connected patterns of financial change: financial integration, asset substitution and monetary integration. Next, the empirical analysis aims at quantifying these patterns for two regions: the FixWorld and the FlexWorld, which differ as to their exchange rate commitment. The results are discussed against the background of some dominant institutional changes in the countries concerned. The policy implications are presented in a monetary policy conflict triangle.

---

1. Introduction

During the last two decades the international financial environment has changed dramatically. The gradual removal of capital controls, the deregulation of financial markets and the advanced information technology have strongly improved the conditions for international borrowing and lending in industrial countries. New techniques and instruments have developed and the market partipicants' attitude towards exploiting arbitrage opportunities has changed. As a result financial markets have got integrated and capital mobility has been able to reach unprecedented levels.

The economics profession has explored the nature and consequences of increased capital mobility in a number of ways. The huge volume of studies can be categorized according to object and method. As to the *object* of consideration one can discern an institutional approach, a quantity approach and a price approach[1]. With respect to the applied *method* both inductive and deductive approaches have been adopted.

Inductive studies focus directly on actual developments. On the basis of *a priori* reasoning, data

* We are grateful to Jacques Sijben, Sjak Smulders, Lans Bovenberg and Theo Nijman for helpful comments on an earlier version of the paper. Of course the usual disclaimer applies.
Parts of this paper have been presented at the International Symposium on Economic Modelling (Athens June 2-4, 1993) at Ecozoekdag (Tilburg University, June 11, 1993) and at an informal research seminar (Antwerp University, October 13, 1993).

1. Feldman (1986).

are investigated and generalized into stylized patterns of change. The observed patterns are described in terms of qualitative features or quantitative indicators. Qualitative research includes the historical analysis of the transformation of markets, institutions, legislation and policy orientation[2]; quantitative research seeks to capture the growth of capital flows and the international diversification of asset holdings in some broad statistics[3].

Deductive studies start with the formulation of a theoretical model in which the degree of international capital mobility is a central parameter. Assuming high or even perfect mobility an operational hypothesis is derived and tested against the data. One example of this approach is the Feldstein-Horioka hypothesis which argues that domestic saving and investment will be less correlated once capital markets become integrated[4]. Another example is the Frankel hypothesis which translates financial integration into the condition of covered interest rate parity[5].

This paper is concerned with the price approach. As to the method it is primarily based upon deduction, but inductive insights will turn out to be indispensable both in the formulation of the model and in the interpretation of the results. Our main purpose is to measure the degree of financial change by studying interest rate differentials across OECD countries. Since interest rates and exchange rates are strongly interconnected, we divide the OECD-area into two regions. In the 'FixWorld' the authorities participate in a currency arrangement, whereas in the 'FlexWorld' exchange rates are left free.

The analytical framework of our analysis is presented in section 2. A simple portfolio model enables us to cluster the various determinants of capital mobility into a price distortion parameter, an adjustment parameter and a substitution parameter. The model is solved for three different regimes, representing three 'states of the world' with respect to the nature and degree of financial change. Each regime is translated into a specific hypothesis about the interdependence of national interest rates. The paper proceeds in section 3 with an empirical analysis of these hypotheses, both for the FixWorld and the FlexWorld. The results are discussed against the background of some institutional changes in the countries concerned. Section 4 contains a short note on the policy implication of our analysis and section 5 concludes.

2. From the numerous papers covering this comprehensive field we mention BIS (1986, p.149-168), Watson *et al* (1988, p.35-49), Bröker (1989), Folkerts-Landau (1989) and OECD (1990).
3. See e.g. Golub (1990), Goldstein, Mathieson and Lane (1991), Turner (1991).
4. Feldstein and Horioka (1980).
5. Frankel (1989).

2. Theoretical framework

Global financial change can manifest itself in different shapes. In this section a portfolio model is designed in order to illuminate the conceptual distinction between financial integration, asset substitution and monetary integration. In view of the empirical testing in section 3, it is essential to be explicit on our interpretation of these three related but different phenomena.

Given the purpose of clarifying the differences between these broad and often confounded concepts, the portfolio framework should be formulated in general terms. For that reason most equations are deliberately specified in functional forms. Every choice for a more explicit model, although probably more elegant from a microeconomic point of view, would render the analysis less general and hence distract from our original aim[6].

In the model a representative investor can diversify his financial wealth between two instruments. One asset is issued at home and denominated in the domestic currency. The other is issued abroad and expressed in a foreign currency. Hence, the assets differ as to the aspects of currency denomination and national jurisdiction. Other asset characteristics such as liquidity, term to maturity and default risk are assumed to be equal. One may think here of government bonds or bank deposits.

In general portfolio decisions will be guided by expected returns, risk perception and environmental factors like legislation, communication systems and market structure. It is useful to elaborate on this by dividing the investment decision into two steps. The first step deals with the *preferred* portfolio and the second one with the *actual* portfolio[7]. The preferred portfolio is an expression of the investor's *willingness* to hold foreign and domestic assets in a certain proportion. The actual portfolio also includes the *ability* of the investor to realize his preferences.

The asset demand functions are assumed to be homogeneous in wealth; thus the preferred share of foreign assets (P*) and the preferred share of domestic assets (1-P*) are independent of the level of financial wealth. With R as the expected return on foreign assets relative to domestic assets and φ as a substitution parameter we write:

$$(1) \qquad P^* = P^*(c, \varphi.R) \qquad 0 \leq P^* \leq 1 \qquad 0 < c < 1 \qquad \partial P^*/\partial R > 0$$

6. For an elaborate survey of the literature on the micro foundations of international portfolio choice see Adler & Dumas (1983).
7. Cf. Kenen (1976), Akhtar and Weiller (1987), Bovenberg and Goulder (1991).

In this equation c represents the share of foreign assets in what might be called the minimum risk-portfolio. The investor will hold more foreign assets ($P^* > c$) only if the expected relative return on foreign assets is large enough to outweigh the associated rise in the overall portfolio risk[8]. Subsequently, the extent to which an international return differential induces a shift in the preferred portfolio depends on the value of the substitution parameter φ. This parameter captures the risk/return attitude of the representative investor as a function of his subjective risk aversion (ρ) and the objective risk characteristics of the assets concerned. Since the two financial instruments are issued in different currencies and under a different legal jurisdiction, we have to take account of a currency risk (CUR) and a political risk (POR). For ease of exposition the distinct risk elements are assumed to be separable and independent from each other. So we write:

$$\text{(2a)} \qquad \varphi = \varphi(\rho, \text{CUR}, \text{POR}) \qquad 0 \leq \varphi \leq \infty$$

The currency risk results from the fact that the *expected* future course of the exchange rate (which is part of R, see below) is subject to uncertainty. The investor incurs a currency risk if he is not able or not willing to hedge his wealth position fully against the exchange rate variability. A political risk is involved as the investor faces the possibility that the power of control over his funds is limited by future exchange restrictions on capital flows[9].

In this way risk aversion and risk characteristics together determine the value of the substitution parameter φ. The larger their product, the lower the degree of substitutability between foreign and domestic assets. With risk averse investors ($\rho > 0$) assets are imperfect substitutes ($\varphi < \infty$) and a rise, for example, in the relative supply of foreign assets will ceteris paribus be absorbed in the investor's preferred portfolio, only after the return differential has increased. This increase is necessary to compensate for the deteriorated risk exposure: it reflects a rise of the required *risk premia*.

Next to the perception of a currency and a political risk, our framework also allows for an *autonomous* bias in the asset demand function towards domestic instruments. This home asset

8. See Dornbusch (1983) or Bovenberg & Goulder (1991, 1993). Dornbusch derives a minimum risk-portfolio in a model with two assets, two goods and a representative agent maximizing his utility as a function of the mean and variance of end-of-period wealth. The minimum risk-, or more precise, minimum variance-portfolio is determined by the relative riskiness of the two assets and is independent from the risk aversion of the investor. If exchange rate risk is the only source of return variability, an individual investor can realize a perfect hedge by equating the share of foreign assets in his portfolio to the share of foreign goods in his spending pattern.
9. Political risk is defined here in a narrow sense as for example by Aliber (1973). A broader definition is applied by Buiter (1983). In his analysis political risk covers legal risk (jurisdictional disputes, the introduction of capital controls), sovereign risk (associated with adverse political events, such as wars, coups and expropriations) and policy risk (policy changes influencing the return on a foreign investment including macroeconomic fiscal and monetary stabilization policy measures).

preference (HAP) refers to the fact that lending abroad can be hampered by a relatively limited knowledge of foreign borrowers (according to Akerlof's lemons' principle) or by a lack of experience with foreign trading practices. But HAP can also be due to some kind of psychological aversion induced e.g. by an uneasy feeling of not having capital under immediate or nearby control[10].

Taking all elements together we get:

$$(2) \qquad \varphi = \varphi\,(\rho.\mathrm{CUR},\ \rho.\mathrm{POR},\ \mathrm{HAP}) \qquad \begin{array}{l} \partial\varphi/\partial\rho < 0 \\ \partial\varphi/\partial\mathrm{CUR} < 0 \\ \partial\varphi/\partial\mathrm{POR} < 0 \\ \partial\varphi/\partial\mathrm{HAP} < 0 \end{array}$$

Figure 1 illustrates the relationship between the preferred portfolio P* and the return differential R for different values of φ. As this figure is restricted to the demand side (for the role of supply see below), the reasoning should go from a *given* R and a *chosen* φ to a *resulting* P*[11].

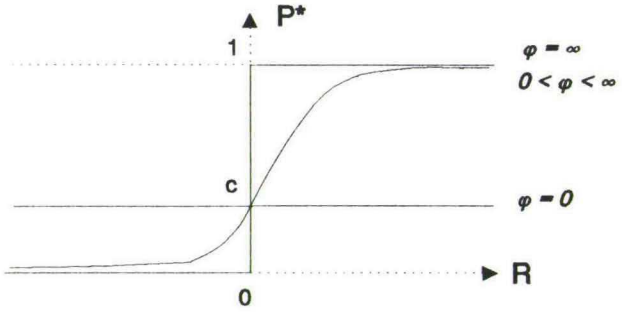


Figure 1: Asset substitution and the preferred portfolio

10. The phenomenon of home asset preference is already mentioned by Ricardo: 'Experience ... shows that the *fancied or real* insecurity of capital, when not under the immediate control of its owner ... check the emigration of capital. These *feelings* induce most men of property to be satisfied with a low rate of profits in their own country, rather than seek a more advantageous employment for their wealth in foreign nations' (1817/ed.1933, p.83; italics ours).
11. A specific functional form for the demand function as depicted in figure 1 is the logistic specification: $P^* = m/(m+e^{-\varphi R})$, in which m equals c/(1-c).

If there is no substitution between foreign and domestic assets, e.g. because investors are extremely risk-averse or have an extremely high preference for home assets, demand does not react to changes in the return differential ($\varphi=0$). In that case the investor will stick to the minimum risk-portfolio ($P^*=c$) whatever the value of R.

At the other extreme, the investor is risk-neutral and unbiased. In that case domestic and foreign assets are perfect substitutes ($\varphi \rightarrow \infty$) and the portfolio distribution alters with the slightest deviation of the return differential from zero (thus $P^*=1$ if $R>0$ and $P^*=0$ if $R<0$).

In the intermediate case of imperfect substitution ($0<\varphi<\infty$), the investor outweighs the expected return differential against the increase in the portfolio risk, before deviating from the minimum risk portfolio (thus $c<P^*<1$ if $R>0$ and $0<P^*<c$ if $R<0$). If the expected return differential is zero, the investor has no incentive to take a 'speculative' position in one of both assets; the preferred shares of the foreign and domestic assets will correspond to their proportions in the minimum risk portfolio ($P^*=c$ if $R=0$).

We now turn to the definition of R and the determination of the actual portfolio P. In both functions the role of capital controls will be made explicit.

The expected relative return on foreign assets (R) is firstly determined by the foreign interest rate (i_f), the domestic interest rate (i_d) and the expected depreciation rate of the foreign currency during the investment period (EDEP). In addition, foreign investment can be discouraged by official price regulations, which affect the *net* relative yield on foreign assets. The authorities can announce a cash deposit requirement on capital outflows; interest payments from abroad can be subjected to an interest rate ceiling or a withholding tax. This kind of *indirect* capital controls is taken account of by the price distortion parameter θ. So we arrive at:

$$(3) \qquad R = \{i_f(1 - \theta) - EDEP\} - i_d \qquad 0 \leq \theta < 1$$

Apart from indirect regulations with respect to the flow of funds across national borders, countries can also resort to *direct* measures. Whereas indirect restrictions are cost-based and therefore part of the yield variable R, the impact of direct or quantitative restrictions on capital movements is quite different.

In a world with direct capital controls investors are not able to bring the actual portfolio (P) in line with the preferred one immediately. If the monetary authorities impose direct barriers, a desired change of P will be hampered. Portfolio shifts involve time and resources if agents are to fulfill the existing procedures or to find ways of evading them. In essence the effect of quantitati-

ve capital restrictions has been to delay or preclude capital movements as intended by investors at a certain moment in time. Hence we write:

$$(4) \qquad \Delta P = \alpha (P^* - P_{-1}) \qquad 0 \leq \alpha \leq 1$$

The parameter α reflects the strength of the regime in force. With $\alpha = 1$ capital transactions are completely free. A change in preferred asset holdings will immediatedly be followed by a change in actual holdings. Hence $P = P^*$ at any moment in time.

For $\alpha < 1$ instantaneous adjustment is not possible. The lower α, the lower the speed of adjustment. In the extreme case of $\alpha = 0$ capital restrictions are prohibitive and P cannot respond to P^* at all. Figure 2 depicts the dynamic adjustment path of P, given P^* and P_{-1}, for different values of α.

In more general terms α can be seen as a broad indicator of the financial environment in which lenders and borrowers operate. This not only includes the extent to which direct capital controls are restrictive, but it also refers to other environmental factors, such as the efficiency of the financial intermediation process and the availability of information needed to complete international transactions.

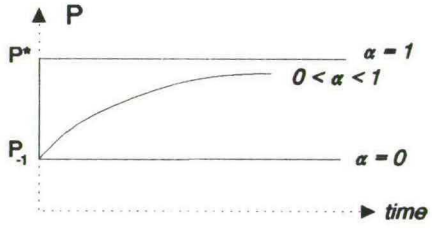


Figure 2: Capital barriers and the actual portfolio

In summary, the semi-reduced form of the model is:

$$(5) \qquad P = P (i_f - i_d; \theta, \alpha, \varphi, EDEP, c, P_{-1})$$

The interest rate differential can be solved if the model is extended with an asset supply function. In the next section we will assume that the supply of domestic and foreign assets is exogenous.

Under such circumstances equation (5) can be used to deduce a number of parity conditions, describing three different regimes of the international economy: financial integration, asset substitution and monetary integration. The regimes differ as to the attached values of θ, α, φ and EDEP.

Regime 1: Financial Integration

We define financial integration as a process by which all environmental obstacles to asset trade disappear. This process is quite comprehensive. It demands a liberalisation of capital movements implying that residents become free to lend or to borrow abroad and non-residents to have access to the domestic financial market. Also indirect controls disappear. It further requires a globalisation of the communication system which means that information is quickly and cheaply available to all market participants. It finally includes the development of international markets with high absorption capacity and transparant transaction procedures.

In our model financial integration primarily influences the adjustment parameter α. As soon as the process of liberalisation and internationalisation has been completed, the financial sector can be labeled as fully integrated. Perfect capital mobility implies that α will be unity; the actual portfolio adjusts instantaneously to a change in the preferred portfolio composition. Besides, the price distortion parameter θ will be affected: for perfect financial integration θ needs to be zero.

If the authorities' action of lifting capital controls is credible, the political risk of holding foreign assets (POR) will undoubtly diminish. So, as financial integration proceeds we might expect the POR-premium to disappear and the degree of substitutability between foreign and domestic assets (φ) to rise. However, the decision to diversify internationally can still be hampered by a domestic bias in the agents' utility function. Moreover, any purchase of foreign assets still entails a currency risk. Hence we conclude that, even in a world of perfect capital mobility the substitution parameter φ will remain finite.

If we take everything together, perfect integration means that our model can be reduced to:

$$P = P^* = P(R', \varphi') \tag{6}$$

with

$$R' = \{i_f - EDEP\} - i_d \tag{2'}$$

and

$$\varphi' = \varphi'(\rho.CUR, HAP) \tag{3'}$$

In equilibrium, given the relative supply of assets, not only the expected depreciation rate but also the perceived currency risk and the autonomous home asset preference are priced. Hence, substituting (2′) and (3′) in (6) implies that the interest rate differential can be written as:

(7) $\quad i_f - i_d = \text{EDEP} + \text{CUR-premium} + \text{HAP-premium}$

In section 3 we will dicuss how (7) can be translated into an operational hypothesis and show whether or not this hypothesis is supported by actual developments.

Regime 2: Asset Substitution

In a financially integrated world domestic and foreign assets can remain imperfect substitutes. To proceed to a world of perfect substitutability, it is necessary that investors:

(i) lose their risk aversion ($\rho \rightarrow 0$, hence POR-premium $\rightarrow$ 0 and CUR-premium $\rightarrow$ 0)
and

(i) lose their systematic preference for home issued securities (HAP-premium $\rightarrow$ 0).

Only if both conditions are fully met the substitution parameter will become infinite. In terms of our model perfect asset substitution presupposes not only $\alpha = 1$ and $\theta = 0$, but also $\varphi \rightarrow \infty$. In such circumstances the actual portfolio is completely elastic to the expected return differential:

(8) $\quad P = P^* = P(R', \varphi \rightarrow \infty)$

With investors both able and eager to exploit all investment opportunities, the slightest return differential provokes a demand surplus in the market for the higher-yielding asset and a supply surplus in the market for the low-yielding asset. Hence, in equilibrium the expected returns on foreign and domestic assets will be equalized. This arbitrage-process results in uncovered interest parity ($R'=0$, or):

(9) $\quad i_f - i_d = \text{EDEP}$

Many textbooks use the uncovered interest parity condition (9) to typify perfect capital mobility[12]. This implies that instantaneous adjustment and asset substitution are not interpreted as different phenomena. Indeed, in a theoretical world with perfect foresight or without uncertainty, equation (7) and (9) are identical. In our more *empirical* approach however, we prefer to draw a

12. See e.g. Dornbusch (1980, p.176).

distinction between the concepts of mobility and substitution, reflecting the ability respectively the willingness of investors to diversify their portfolios internationally[13].

Regime 3: Monetary Integration

The third regime we would like to present refers to the process of monetary integration which should clearly be distinguished from financial integration. Whereas the latter is a dominant trend in all industrial countries, the former is confined to the European Community. Ever since its foundation a high priority has been given to the stabilisation of bilateral exchange rates. By participating in a formal exchange rate mechanism (Bretton Woods, the Snake, the EMS) European countries have always sought to establish a zone of monetary stability, be it with a varying degree of success, in order to stimulate intra-trade, investment and prosperity.

We define monetary integration as the combination of financial integration *and* the gradual disappearance of exchange rate changes. This process starts as soon as national authorities decide to peg the external value of their currencies to a common anchor without relying on capital controls. If this commitment is credible exchange rate fluctuations can diminish and ultimately even disappear. An important condition in this respect is the close coordination of macroeconomic policies among the participating countries. For, if expected inflation differentials have not been eliminated, sooner or later the process of monetary integration will lose momentum.

We will call monetary integration perfect if capital controls have been abolished ànd market participants no longer expect the bilateral exchange rates to change at all. The sustainability of such an arrangement requires a high degree of policy convergence. With free capital movements one might even argue that a permanent locking of exchange rates with no margin of fluctuations, requires monetary policy to be completely centralized and fiscal policy to be strongly harmonized[14]. In such a situation, which can be interpreted as a *de facto* currency union, both EDEP and CUR have lost their role. So equation (7) can be reduced to:

$$(10) \qquad i_f - i_d = \text{HAP-premium}$$

Neither capital controls (α, θ, POR), nor exchange rate expectations (EDEP) and exchange rate uncertainty (CUR) can drive a wedge between the nominal interest rates of the countries concerned. In that case arbitrage in the financial markets ensures the equalisation of nominal returns, unless home asset preferences (HAP) prevent domestic and foreign assets from being

13. For other ways to distinguish between financial integration and asset substitution see Kenen (1976, p.20) or Golub (1990, p.425). Lemmen and Eijffinger (1993) speak of capital mobility type 1 and capital mobility type 2.
14. EC (1990)

perfect substitutes[15].

Summary of regime definitions

In summary we may conclude that financial integration, asset substitution and monetary integration differ fundamentally as to their nature and characteristics. But it has also become clear that the three 'worlds' are analytically connected by the fact that the underlying assumptions have an increasing order of specificity. Scheme 1 summarizes how the various elements of our regime definitions are related.

SCHEME 1: Regime definitions

Assumptions	Symbols	Perfect Financial Integration	Perfect Asset Substitution	Perfect Monetary Integration
No regulatory barriers	$\alpha = 1$ $\theta = 0$	*	*	*
No political risk premium	ρ.CUR = 0	*	*	*
No systematic home asset preference	HAP = 0		*	
No currency risk premium	ρ.CUR = 0		*	*
Stable exchange rate expectations	EDEP = 0			*

15. If home asset preferences are absent regime 3 might be interpreted as a special case of regime 2: perfect substitutability with EDEP = 0 as an additional requirement. However, there is a subtle difference: perfect substitutability under regime 2 relies on the assumption that investors are neutral or indifferent towards currency risks (ρ = 0). In the extreme case of *perfect* monetary convergence under regime 3, there is no currency risk premium because there is no exchange rate uncertainty left (CUR = 0).

3. Empirical implementation and results

We now turn to the issue of quantifying the historical pattern of financial change in the OECD area. To this end the parity conditions (7), (9) and (10), each referring to another regime, will be translated into a set of *aggregate dispersion measures*. Each measure captures the mean absolute deviation from interest rate parity for a group of countries against a common reference rate[16]. In general:

$$(12) \qquad ADM_t = \frac{1}{n} \sum_{j=1}^{n} |i_{j,t} - (i_{ref,t} - COR_t)|$$

with ADM_t = aggregate dispersion measure at moment t
n = number of countries
$i_{j,t}$ = domestic interest rate of country j at moment t
$i_{ref,t}$ = reference rate at moment t
COR_t = regime correction term

Depending on the regime under consideration the reference rate has to be adjusted for exchange rate expectations and/or risk premia. The derived parity conditions prescribe which elements should be included in the regime correction term (COR). Subsequently some additional assumptions are necessary to make the dispersion measure operational. In scheme 2 the empirical implementation of each regime has been summarized. Basically, financial integration is measured by *covered* interest rate parity, asset substitution by *uncovered* interest rate parity and monetary integration by *nominal* interest rate parity.

Under the hypothesis of perfect financial integration a bilateral interest rate differential can only be attributed to currency factors (EDEP, CUR-premium) and/or to home-asset preference (HAP-premium). The correction term should therefore include these elements, but the problem is that none of them is directly observable. Our solution is to confine the analysis to *short term* yields which enables us to replace the currency factors by the forward discount on foreign currency[17]. In fact we then suppose investors to hedge against any exchange rate change which makes the

16. In designing this multinational statistic we were inspired by Kasman and Pigott (1988). Their reference rate however is a 'world' interest rate, artificially constructed as the simple average of the interest rates prevailing in the countries of their sample. Besides they do not make a difference between countries with (managed) floating exchange rates and countries participating in a fixed exchange rate mechanism as we will do further onwards.
17. In this we follow Frankel (1986 and 1989).

(certain) return on foreign assets equal to i_{ref} minus the forward discount. Taking in this way the covered return differential as an indicator for financial segmentation we are left with one additional assumption i.c. the absence of a home asset preference. Because of the transparancy of money markets (relative to that of bond and equity markets) this neglect of a possible HAP-premium seems acceptable.

SCHEME 2: Aggregate dispersion measures for three regimes of financial change[18].

Regime 1: Financial Integration

COR: EDEP + CUR-premium + HAP-premium

OA: EDEP and CUR-premium replaced by the forward discount (FD) of the reference currency against the domestic currency; HAP-premium neglected.

ADM: $\frac{1}{n} \sum_{j=1}^{n} |i_j - (i_{ref} - FD_{ref,j})|$

Regime 2: Asset Substitution

COR: EDEP

OA: EDEP replaced by the actual depreciation (DEP) of the reference currency against the domestic currency during the investment period.

ADM: $\frac{1}{n} \sum_{j=1}^{n} |i_j - (i_{ref} - DEP_{ref,j})|$

Regime 3: Monetary Integration

COR: HAP-premium

OA: HAP-premium neglected.

ADM: $\frac{1}{n} \sum_{j=1}^{n} |i_j - i_{ref}|$

18. COR = regime correction term, OA = operational assumption(s), ADM = aggregate dispersion measure. To simplify the notation time-indices have been suppressed.

For the other regimes the correction term is treated analogously. In regime 2 the reference rate has to be adjusted for the expected depreciation rate of the foreign currency. Using rational expectations as the operational assumption, the hypothesis of perfect substitutability comes down to the *ex post* equalization of returns across countries except for a random error term which reflects the *unexpected* change of the exchange rate[19]. Finally, in regime 3 the correction term only includes a HAP-premium, which we neglect for the same reason as mentioned under regime 1.

The ADM's presented in scheme 2, are calculated for two regions, labeled *FixWorld* and *FlexWorld*. The countries of the FixWorld have participated in the exchange rate mechanism of the EMS for a prolonged period of time. The FlexWorld-countries are not tied by official obligations neither to intervene in the foreign exchange markets, nor to adapt domestic interest rates in response to exchange market pressures. Although they may have pursued a policy managed floating their commitment is rather weak. Given this *ex ante* subdivision of our sample the availability of data limits the number of countries to six for the FlexWorld and six for the FixWorld[20].

Fixworld: Belgium, Denmark, France, Germany, Italy and The Netherlands.
Flexworld: Australia, Canada, Germany, Japan, United Kingdom and United States.

All ADMs are calculated on a monthly basis; the observation period is 1973/3-1993/11; data are taken from the DATASTREAM International Database. The *domestic* interest rates (i_j) are predominantly three month (interbank) deposit rates; the *reference* rate (i_{ref}) is a three month Euro$rate for the FlexWorld and a three month EuroDMrate for the FixWorld. Since Eurocurrency markets are virtually free from reserve requirements, withholding taxes and other regulations, the use of a Euro-rate as the common point of reference garantees that for each j the (covered) ADM isolates as much as possible the effect of capital controls in the country concerned.
The patterns of financial change, condensed in six ADMs, are plotted in graph 1, 2 and 3 and will be discussed successively[21].

19. As a consequence the empirical investigation of this regime implies the testing of a *joint* hypothesis. This problem will be discussed later on.
20. Germany is included in both Worlds; this country is assumed to represent the floating of the FixWorld-block within the FlexWorld.
21. Bars on the horizontal axis refer to mid year estimates unless indicated otherwise.

Regime 1: Financial Integration.

The ADMs of Graph 1 show the mean absolute deviation from covered interest parity within the FlexWorld and the FixWorld. Remaining yield differentials reflect regulatory obstacles to arbitrage, especially capital controls and political risk premia[22]. If, in other words the covered ADM is high, there is little reason to accept the hypothesis of perfect financial integration.

Capital controls are basically a policy instrument to shelter the domestic economy from potentially destabilising capital flows. As a tool of exchange rate management they are called upon to offset short term market pressure. More important perhaps, in countries with a strong exchange rate commitment the restrictions offer the policymakers some autonomy over the domestic money supply or the domestic interest rate, at least in the short run.

In the early seventies (1970-1973), Japan and the European countries relied heavily on capital controls. Nevertheless, they were unable to stem the huge capital inflows from the United States. When the failure of the Smithsonian Agreement put an end to the Bretton Woods System the larger countries resorted to individual floating, while the countries of the European Community decided to block floating, first within the Snake, later within the EMS. The pattern displayed by the covered ADMs in Graph 1 corresponds closely to the gradual liberalisation of capital movements since then[23].

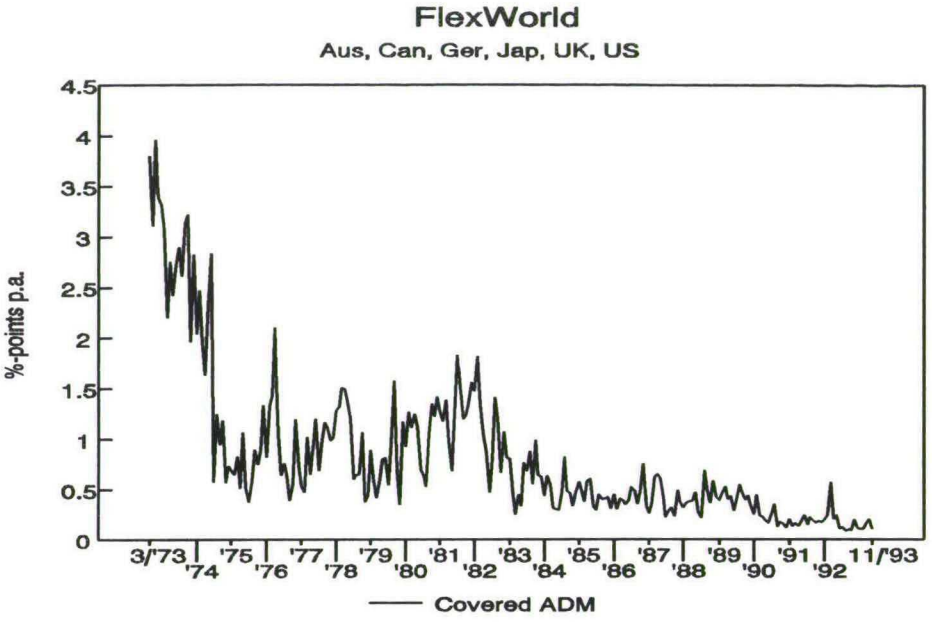
FlexWorld

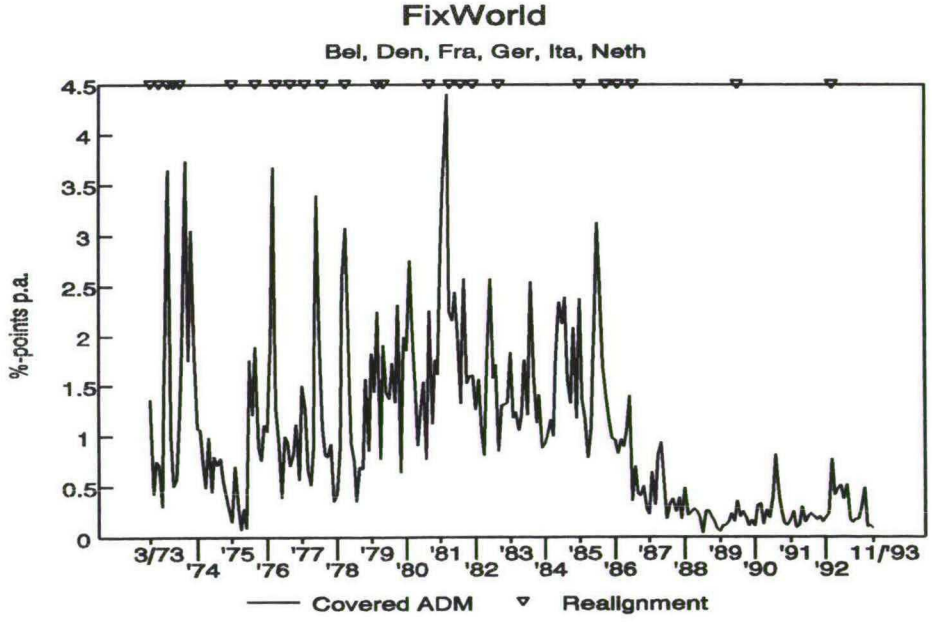
In the FlexWorld-countries the ADM drops quickly after the transition to floating exchange rates in the beginning of the 1970s. In 1974 the *United States* and *Canada* liberalised capital outflows while *Germany*, *Japan* and *Australia* relaxed the restrictions on capital inflows[24]. There were several driving forces behind this development. As the stabilization of the exchange rate became a less binding policy objective, the need for capital controls as an additional instrument to maintain control over the domestic monetary situation seemed to diminish. For some countries another motive for liberalising capital inflows was the weakened balance of payments position after the first oil crisis.

This early liberalisation trend did not persist very long. The behaviour of the ADM during the second half of the 1970s fits in with the reintroduction of capital controls by Germany, Switzerland and Australia. In Japan the application of restrictions responded in a consistent way to the

22. The role of transaction costs and data imperfections will be discussed later on.
23. For the deregulation of international transactions and the driving forces behind the liberalisation process, see e.g. Lamfalussy (1981, p. 194-203), Van den Bergh (1987), OECD (1990, p. 32-47) and Van Gemert & Gruijters (1992).
24. Due to the limited availability of data Japan and Australia enter the analysis not before February 1977 respectively March 1977.

GRAPH 1: Financial Integration





position of the current account[25]. With a growing surplus in 1977 net capital inflows were discouraged, but after a deterioration of the current account in 1979, the Japanese policymakers reversed the controls and stimulated net inflows.

A second, more comprehensive and lasting wave of financial integration in the FlexWorld started in 1979. In the *United Kingdom* the free market philosophy of the Thatcher administration gave new impetus to the liberalisation process. Within a few months all British capital controls were abolished. Thereupon the second oil crisis induced the abolition of the remaining restrictions on capital inflows in *Germany*. In 1980 new legislation in *Japan* changed the system of capital regulations fundamentally, but it took severe political pressure, exerted by the United States in 1984, before the Japanese government made serious commitments to liberalise capital flows and to facilitate the access of non-residents to the domestic financial markets. In December 1983 *Australia* abolished almost all restrictions on capital flows. This liberalisation was the result of a policy switch to free floating, after a decade of pegging the Australian dollar to a currency basket. Finally, during 1984 the United States, Germany and Japan repealed their withholding taxes on interest payments to non-residents.

These regulatory changes are accompanied by a sharp decrease in both the level and the volatility of the aggregate dispersion measure during the first half of the 1980s. This behaviour indicates that the speed of financial integration was high. By now the mean covered interest differential has been less than 0.5 percent for a decade or so[26]. Hence we do not hesitate to conclude that the process of financial integration in the FlexWorld was completed in the mid 1980s.

FixWorld

In general, the differences between the Fixworld and the FlexWorld are striking. First of all, interest rate differentials in the FixWorld have lasted for a rather long period; in fact they continu-

25. See Argy (1982, p. 46-54) and Ito (1986).
26. At first glance, a level of ±50 basispoints for the ADM since 1983/'84, might seem high for integrated financial markets. One should realize however that this deviation does not imply automatically an unexploited *net* profit opportunity for two reasons. First, the arbitrager faces transaction costs in the spot exchange market, the forward market, and in the deposit markets. Estimates of the transactions costs differ. Keynes (1924, p. 128) suggested for example: "*..such amount (say ½ per cent) will yield the arbitragers sufficient profit for their trouble.*". Frenkel & Levich(1981) come up with estimates ranging between 48 and 59 basispoints for transaction costs in the US$/£ currency market. Their method is critized for overestimating the actual costs, see e.g. McCormick (1979). As there are no capital controls nor differences in political risk in *one* financial centre, covered interest rate disparities *within* Eurocurrencymarkets may serve as a crude indicator of transactions costs for a round trip. For example in our data-set, the mean absolute deviation for the Eurodollar- and the EuroDMmarket is 22 basispoints in the period 1973-1993. The second reason for remaining deviations are imperfections in the data-set: ideally, the monthly observations for the spot rate, the forward rate and the interest rates should be made within the same minute, because all transactions involved in arbitrage can be made within seconds. To our knowledge there are no data-sources that can garantee for a sample of eleven countries over a period of twenty years, such a high level of accuracy. Therefore, part of the differentials are to be attributed to time-lags between the observations for the interest rates and the exchange rates.

ed unabated until 1989/'90. Second, the ADM of the FixWorld fluctuates at a relatively high level and also exhibits a relatively high volatility. Those observations indicate a lesser degree of financial integration for much of the observation period. We consider this result quite comprehensive as it represents the extensive and discretionary use of capital controls by countries with an explicit exchange rate objective.

The early decrease in the ADM of the FixWorld corresponds to the relaxation of capital restrictions by Germany, the Netherlands and France in 1974/'75[27]. This drop, however, was only incidental. France and Italy reversed their control systems: these countries liberalised inflows but regulated outflows in response to the deterioration of the external position. Other countries, too, maintained or re-introduced parts of the control system during both the Snake-period and the turbulent starting period of the EMS.

In the early stages of the EMS there was a discrepancy in the use of controls. *Germany* and *The Netherlands* liberalised capital flows in 1981, while the 'weak currency' countries, viz. France, Italy, Belgium and Denmark, regulated capital outflows. This discrepancy is often interpreted as a consequence of the asymmetric functioning of the EMS[28]. In this view the 'anchor' country Germany determines the monetary policy stance of the entire system, while the 'periphery' countries align their policy to defend the exchange rate[29]. However, the weak currency countries did not wish to refrain completely from domestic policy objectives and tried to stabilise the exchange rate with capital controls.

In practice, the regulations offered them only a modest degree of monetary sovereignty: in time, the financial markets devised new instruments and new methods to avoid the regulations[30]. These financial innovations forced the policy maker either to accept the discipline of the exchange rate mechanism and adapt its policy, or to extend the control system continuously. Nevertheless, in the short run the controls could be effective in breaking the link between the domestic and the foreign interest rate; the restrictions became especially binding on capital outflows in periods of turmoil, as the financial markets anticipated an exchange rate realignment. This seems to explain the high volatility of the ADM in the wake of EMS-realignments[31].

The controls were unable to prevent realignments. The devaluations in the early stages of the EMS did not improve the current account balance of the 'weak currency'-countries. The frequency

27. At the same time, Denmark and Italy liberalized capital inflows, but they are not included in the ADM until January 1976 respectively January 1977, because of the limited availability of data.
28. For this interpretation see e.g. Giovannini (1989).
29. For a discussion see Gros & Thygesen (1992, p. 136-150).
30. See e.g. Wihlborg (1982).
31. In a more detailed empirical analysis Giavazzi & Pagano (1988, p. 270-278) draw the conclusion that the French controls were effective in both periods of EMS-turmoil and EMS-calm, while the Italian controls were only able to drive a wedge between the domestic rate and the 'offshore' rate before EMS realignments.

of the realignments harmed the reputation of the policymakers and sparked inflationary expectations. Eventually, they abandoned discretionary domestic policies and gave priority to stabilising the exchange rate according to the asymmetric functioning of the EMS.

In *Denmark*, a new elected conservative administration radically changed the course of its exchange rate policy in October 1982. A firm exchange rate objective, supported by a tight fiscal policy and wage guidelines, turned out to be more successful in reducing the domestic interest rate[32]. As the exchange rate policy gained more credibility, Denmark was able to relax its capital regulations substantially in the period 1983/'86.

In the second half of the eighties, the relatively favorable economic developments and the internal market program of the European Commission carried the liberalisation process even further. After the removal of the most important capital controls by the Chirac administration in 1986/'87, *France* complied with the European directives concerning the liberalisation of capital movements. *Italy* followed the French example at short distance. An improvement of the external balance provided the opportunity to dismantle the capital restrictions gradually. The new foreign exchange law of January 1988 changed the Italian control system fundamentally, although some rules for short-term transactions remained in force.

Since July 1990 the provisions of the EC-directives ensuring the freedom of capital flows are incorporated in the legislation of the member states. Indeed, as reflected by the low level of the ADM, capital movements were hardly impeded at the end of the decade. We conclude that next to the Flexworld also the FixWorld can nowadays be characterised as a region of perfect financial integration.

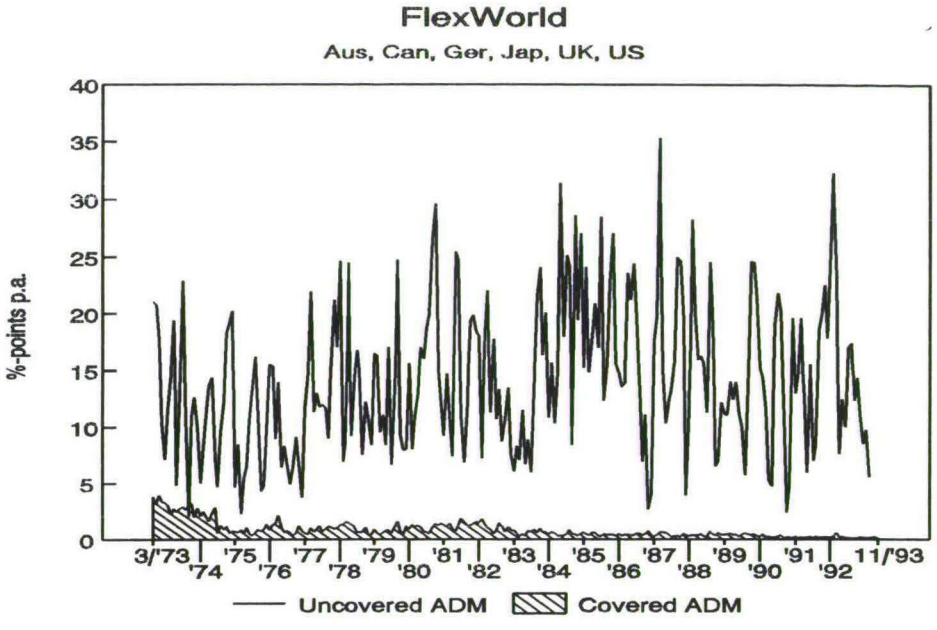
Regime 2: Asset Substitution

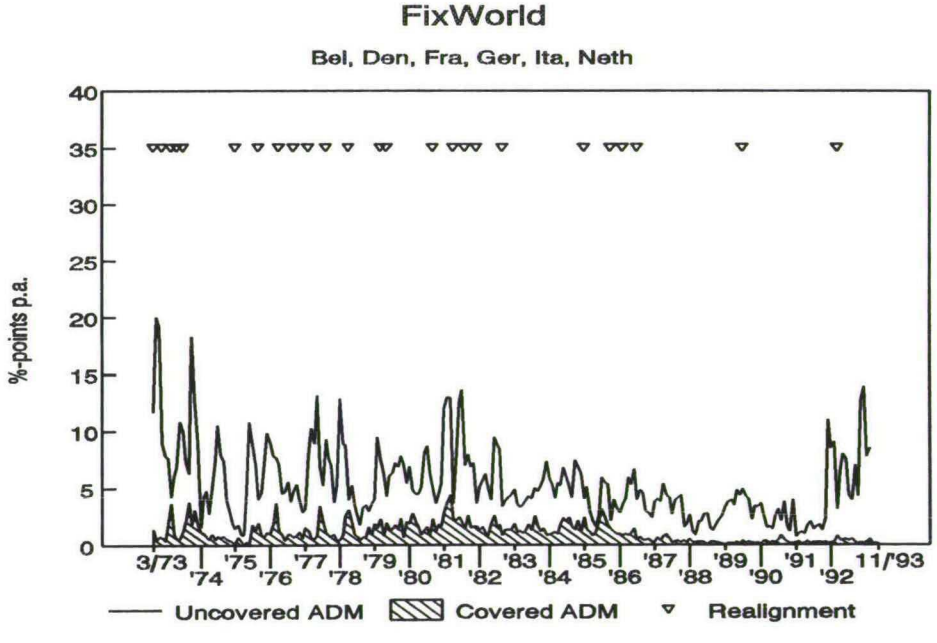
Financial integration does not automatically imply perfect substitutability. As elaborated above, the hypothesis of perfect substitution imposes both the absence of regulatory barriers ànd a general indifference of the representative investor in his choice to hold foreign or domestic assets: he is neither afflicted with a home asset preference nor does he perceive any currency or political risks. Only under these conditions will interest arbitrage ensure *ex-ante* uncovered interest rate parity.

The empirical implementation of this condition runs up against a serious problem. As explained in scheme 2 we have to assume rational exchange rate expectations. Hence, the analysis of this regime is hampered by the inescapability of a *joint* hypothesis: ex post uncovered interest rate differentials can be the result of time varying risk-premia (including a home asset preference)

29. See Andersen & Risager (1988, p.674-678).

GRAPH 2: Asset Substitution





and/or the release of new information[33].

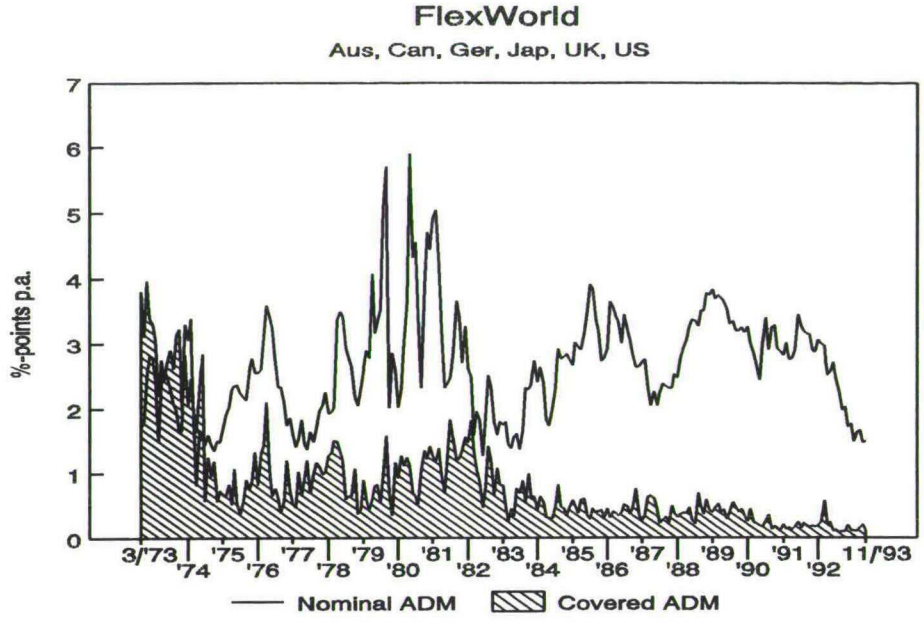
Graph 2 presents the mean absolute deviation from uncovered interest parity within the FlexWorld and the FixWorld. The covered dispersion measure is included too. As explained the distance between the uncovered ADM and the covered ADM can be due to imperfect asset substitution and/or to expectational errors. Both ADMs display a remarkably different pattern. In the *FlexWorld*, the uncovered return differential fluctuates strongly around a high mean throughout the whole sample period. It seems reasonable to attribute this to the uncertainty about the future course of the bilateral exchange rates against the US$. Undoubtedly this uncertainty gives rise to both substantial risk premiums and to non-negligible errors in the prediction of exchange rates[34]. In the *FixWorld* both the level and the volatility of the aggregate dispersion measure is far below its counterpart in the FlexWorld[35]. The proclaimed efforts of the authorities to achieve stable exchange rates are likely to be responsible for this result. Moreover, this region seems to have experienced an increasing substitutability of assets during the 1980s, but this process was abruptly reversed in the eve of the EMS-crisis of September 1992. We conclude that, not only conceptually but also empirically, financial integration and asset substitution are very different phenomena. On the other hand the analysis strongly suggests that asset substitutability should be seen in relation to the prevailing exchange rate system. We therefore consider this regime as an intermediate case and precede quickly to the regime of monetary integration.

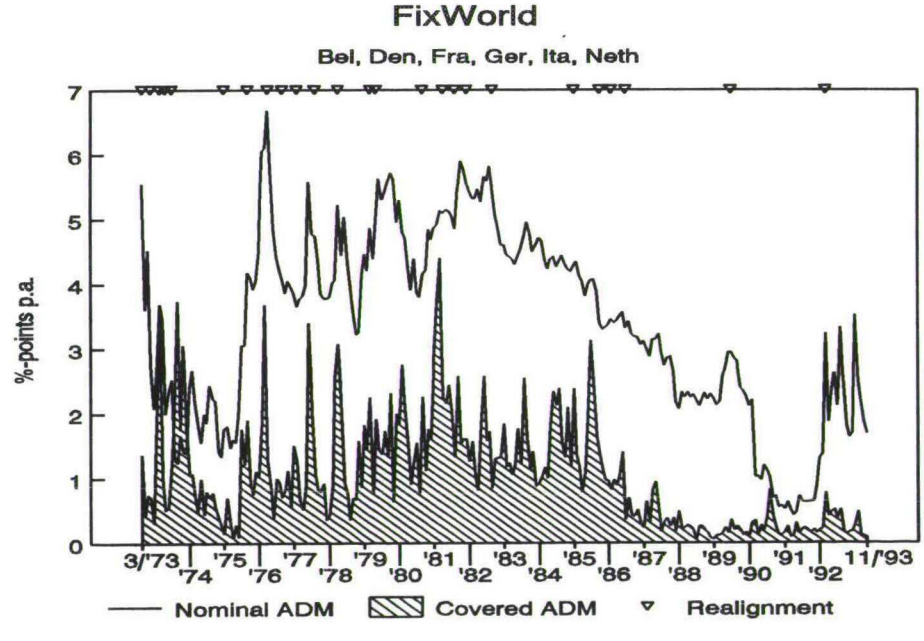
Regime 3: Monetary Integration

We see monetary integration as the combination of financial integration and exchange rate stability. Graph 3 depicts the mean absolute deviation from nominal interest parity as an aggregate measure of monetary integration in the FlexWorld and the FixWorld. Since the nominal interest

33. See e.g. Boughton (1988, p. 12-14) for an overview of the empirical literature on uncovered interest parity. An alternative to the rational expectations hypothesis is the use of survey-data on exchange rate expectations of market participants. The use of these data is however, severely critized, see for example Hodrick (1987) and Koedijk & Ott (1987): the market participants would not have an incentive to reveal their true expectation; besides, the average expectation of the survey might not contain useful information on the future course of the spot rate as the agents with extreme expectations are those who will take speculative positions and drive the spot rate.
34. In the literature, considerable effort has been dedicated to modeling and estimating the exchange risk premium. The results are mixed; although there are empirical indications for the existence of a time-varying risk premium (see e.g. Fama (1984)), it turns out to be impossible to obtain estimates of the premium that can explain the magnitude of the uncovered interest rate differentials. See e.g. Boothe & Longworth (1986) and Frankel (1988). Other empirical studies using survey-data on exchange rate expectations, e.g. Ito (1990) and Frankel & Froot (1990), point to the presence of large and systematic expectation errors. Explanations for this apparent irrational behavior of economic agents within the paradigm of rationality, range from the 'peso'-problem to speculative 'bubbles'.
35. This conclusion corresponds to the results of Ayuso & Restoy (1992, p. 24-25): "... Evaluation of the risk premia highlights the notable difference between the risk run on investing in ERM currencies and in those of non-ERM members. ...deposits in dollars and yen thus incorporate substantial risk premia, while those associated with the D-mark, the French franc, the lira, the peseta and, to a lesser extent (owing to its later membership of the ERM), sterling are on a much more moderate scale ...".

GRAPH 3: Monetary Integration





rates are readily available the calculation of the ADMs does not rely on any operational assumption.

The covered ADMs of Graph 1 are replotted here in order to get a complete picture. We recall that the distance between the nominal and the covered ADM encompasses two elements:

(i) the expected exchange rate changes against the US$ (for the FlexWorld countries) or against the DM (for the FixWorld countries), and

(ii) the uncertainty surrounding these expectations.

As to the *FlexWorld* it does not come as a surprise that the nominal ADM lacks a clear downward trend. In general, the low priority given to exchange rate stability and to international policy coordination, has given the economic agents little reason to assume constant exchange rates. At times the dominance of internal objectives pushed short term interest rates in different directions. This asymmetry made bilateral exchange rates rather volatile which in turn pushed expectations and feeded uncertainty. The high volatility of the nominal interest rate differentials in the period 1979/'82 coincides with the change in the operating procedures of the Federal Reserve in the US. Since then, the ADM has fluctuated around a level of approximately 3 percent per annum. The last upsurge in interest rate dispersions dates back to 1991/'92 and can be attributed to a divergent monetary policy stance in the United States and Germany. In short, although the abolition of capital controls *per se* has caused interest rates to converge, this tendency has apparently been offset by the impact of policy disparities on exchange rate behaviour.

Again, the pattern for the *FixWorld* is quite different. During the Snake-period (1972/4-1979/3) the European countries did not live up to their exchange rate commitment very seriously. Several countries abandoned the arrangement and the system experienced five realignments within a period of two years (1976/10-1978/10)[36]. In the early 1980s, however, the nominal ADM started to decline and a gradual but consistent decrease could take place. Clearly financial integration went hand in hand with monetary convergence. At the time of the Maastricht Treaty (1992/12) the aggregate dispersion measure was less than 0.5. This reflects that free capital movements were accompanied by a virtually complete stabilisation of exchange rate expectations.

This downward trend in the nominal ADM is undoubtedly related to the disciplinary effect associated with the exchange rate mechanism of the EMS. Initially the system mainly survived thanks to capital controls and realignments. Subsequently the main characteristics became

36. The United Kingdom left the snake in 1972/6; Denmark also in 1972/6, but it re-entered in 1972/10; Italy left the snake in 1973/2; France abandoned the system in 1974/1, but re-entered in 1975/7. After eight months France recurred to floating again in 1976/3. Sweden left the snake in 1977/8 and Norway in 1978/12. In the end Germany, the Benelux and Denmark were the only participants.

liberalisation and convergence. Member countries adopted a stability oriented policy. The need for realignments virtually disappeared and to the extent that the authorities gathered reputation, could interest rate differentials could gradually be reduced.

The actual convergence of monetary policies and inflation rates achieved under the EMS, has been remarkable but not complete[37]. By now it is generally accepted that the observed pattern of monetary integration in the FixWorld also originates from a growing confidence of the financial markets in the *prospects* for convergence. The liberalisation of capital flows, the run of success in the stabilization of exchange rates and the perspective of a fully-fledged monetary union made markets euphoric. Institutional investors were tempted to shift their portfolios from hard-currency markets to other markets, including the outer fringe of the EC[38].

The rise of the ADM in the middle of 1992 reveals that the transition to a world of perfect monetary integration was suddenly interrupted. Markets' optimism broke down in response to the coincidence of a number of events: political problems with the ratification of the Maastricht Treaty, a contractive monetary policy stance in unified Germany and a deteriorating economic outlook in most other member states. With two currency crises and a widening of the fluctuation margins exchange rate uncertainty and instable expectations have resurged. This accounts for a considerable wedge between the bilateral interest rates of the FixWorld countries at the end of the observation period.

37. See De Grauwe (1992), who points out that the convergence of inflation *rates* in the EMS was accompanied by a divergence of price *levels*. He therefore warns that the erosion of competitiveness of countries like Italy and Spain will lead to devaluations and, as a result to a setback in the European integration process.
38. See Vliegenthart (1993) and G10 (1993), p.24-25 and p.76-77.

4. Financial change and the monetary policy dilemma

The implication of financial change for the scope of monetary policy is depicted in Figure 3[39]. The inconsistency between perfect capital mobility, fixed exchange rates and domestic monetary policy autonomy implies that countries can combine only two of these items. In a world of perfect financial integration this conflicting situation forces countries to choose a position somewhere on the horizontal axis of the triangle.

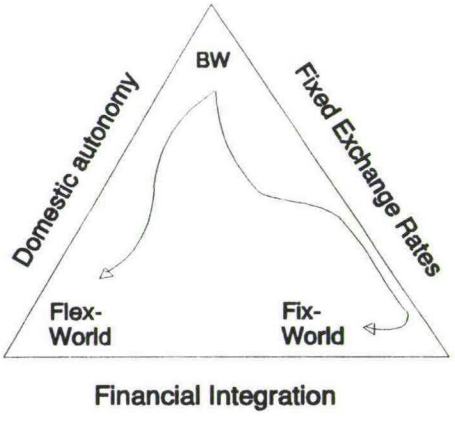


Figure 3: The conflict triangle of monetary policy

In short, the post-Bretton Woods history of financial change in the OECD-area can be seen as a transition process which has pushed countries from the top of the triangle to the bottom line. The *FixWorld* countries, aiming at a zone of monetary stability in western Europe, have chosen to follow a route near to the 'fixed exchange rate' axis. In principle this implies a loss of domestic autonomy. Because of the desire to maintain at least some autonomy, during much of the Snake and EMS-period the distance to both the 'fixed exchange rate' axis and the 'financial integration'

39. Cf. the monetary policy triangle in Oxelheim (1990, p.10) and EC (1990, p.43). See also Jager (1991, p. 475): "...With the advance of financial liberalisation and the concomitant outburst of international financial flows, the so-called 'international incompatible trinity' has become topical..."

axis was considerable. Fluctuation margins, realignments, the option of leaving the system and (until shortly) the use of capital controls have always been part of the system.

The Maastricht Treaty was an attempt to proceed to the very right hand corner of the triangle. In that corner the combination of fully liberalised capital movements and irrevocably fixed exchange rates makes divergent policies of demand management no longer feasible at all: monetary integration has become perfect and monetary policy is completely restricted by the external constraint. The apparent or perceived unwilligness of member countries to accept this consequence has contributed much to the interruption of the monetary integration process in 1992.

For the *FlexWorld* countries the followed route is situated near to the 'domestic autonomy' axis, taking only some distance in ad-hoc periods when exchange rate management got priority. Although capital mobility increased and even became perfect the floating exchange rate leaves the authorities much room to base their policies on domestic considerations. Surely, policy induced exchange rate fluctuations can affect internal objectives like inflation, production and employment. This external transmission channel undoubtedly complicates the design of a proper policy. But, since a floating exchange rate accounts for an imperfect substitutability of foreign and domestic assets, there is ample room to use the interest rate as an instrument to target nominal spending.

4. Conclusions

By distinguishing the various determinants of international portfolio diversification, we have been able to define three related but different patterns of financial change. Empirical results were obtained by calculating a multinational statistic capturing the adjusted interest rate differentials across national money markets. OECD-countries were pooled into two samples, one representing the region with floating exchange rates and the other referring to the EMS. Our main findings are:

* During the last two decades direct capital controls and indirect price regulations have been used extensively as instruments to isolate the domestic from the foreign market. The gradual disappearence of these institutional barriers is called financial integration. In the FlexWorld perfect financial integration was reached in two steps, one around 1974 and one around 1982. Since then the deviations from covered interest rate parity have been small. In the FixWorld financial integration was only completed in the late 1980s. This relatively slow pace of capital liberalisation is due to the EMS-authorities' initial attempt to preserve some monetary sovereignty.
* Instantaneous adjustment does not automatically imply perfect substitution. With free capital movements the investors' willingness to buy foreign assets is conditional on their risk perception. Notably currency risks and a home asset preference can prevent expected yields from being equalized completely. The deviations from uncovered interest rate parity suggest that asset substitutability has increased only in the FixWorld. However, our analysis was hampered by the operational assumption of rational exchange rate expectations.
* Interest rates are strongly interconnected with exchange rate expectations. In the FlexWorld these expectations and the associated currency risk premiums cause nominal rates to diverge considerably. For the FixWorld the deviations from nominal interest rate parity have diminished significantly in the years 1982/92. The combination of financial integration and (perceived) monetary convergence accounts for this result. Since mid-1992 the turmoil in the EMS has caused a marked reversion of the aggregate dispersion measure.
* Financial change has strong implications for the scope of monetary policy. In the FixWorld the combination of free capital movements and fixed exchange rates is incompatible with the desire to maintain domestic monetary policy autonomy. In the FlexWorld the combination of free capital movements and domestic policy autonomy is incompatible with exchange rate stability. Since there is no way back to the reintroduction of capital controls authorities have to live with this dilemma.

References

Adler, Michael and Bernard Dumas (1983), International Portfolio Choice and Corporation Finance: A Synthesis, *The Journal of Finance*, vol. 38, no. 3, p. 925-984.

Akthar, M.A. and K. Weiler (1987), Developments in International Capital Mobility: A Perspective on the Underlying Forces and the Empirical Literature, in: Federal Reserve Bank of New York, *Research papers on International Integration of Financial markets and U.S. Monetary policy*.

Aliber, Robert Z. (1973), The Interest Rate Parity Theorem: A Reinterpretation, *Journal of Political Economy*, vol. 81, p. 1451-1459.

Andersen, Torben M. and Ole Risager (1988), Stabilization Policies, Credibility and Interest Rate Determination in a Small Open Economy, *European Economic Review*, vol. 32, p. 669-679.

Argy, Victor (1982), Exchange-Rate Managment in Theory and Practice, *Studies in International Finance*, no. 50, Princeton.

Ayuso, Juan and Fernando Restoy (1992), Efficiency and Risk Premia in Foreign Exchange Markets, *Banco de España, Servicio de Estudios Documento de Trabajo*, no. 9225.

Bergh, P. van den (1987), Deregulering van de Internationale Financiële Stromen en Valutastelsel, (Deregulation of International Capital Flows and the Currency System), *Rotterdams Monetaire Studies*, no. 30.

Boothe, P. and D. Longworth (1986), Foreign Exchange Market Efficiency Tests: Implications of recent empirical findings, *Journal of International Money and Finance*, vol. 5, p. 135-152.

Bovenberg, A. Lans and Lawrence H. Goulder (1991), Introducing Intertemporal and Open Economy Features in Applied general Equilibrium Models, *De Economist*, vol. 139, no. 2, p. 47-64.

Bovenberg, A. Lans and Lawrence H. Goulder (1993), Promoting Investment under International Capital Mobility: An Intertemporal General Equilibrium Approach, *The Scandinavian Journal of Economics*, vol. 95, no. 2, p. 133-156.

BIS (1986), *Recent Innovations in International Banking*, Basel.

Boughton, James M. (1988), The Monetary Approach to Exchange Rates: What now remains?, *Essays in International Finance*, no. 171, Princeton

Bröker G. (1989), *Competition in Banking - Trends in Banking Structure and Regulation in OECD Countries*, OECD, Parijs.

Buiter, Willem H. (1983), Implications for the Adjustment Process of International Asset Risks: Exchange Controls, Intervention and Policy Risk, and Sovereign Risk, in: R. Hawkins, R.M. Levich & C.G. Wihlborg (eds.), *Research in International Business and Finance*, vol. 3, JAI Press Inc., Greenwich, CT., p. 69-102.

Dornbusch, Rudiger (1980), *Open Economy Macroeconomics*, Basic Books, Inc. Publishers, New York.

Dornbusch, Rudiger (1983), Exchange Rate Risk and the Macroeconomics of Exchange Rate Determination, in: R. Hawkins, R.M. Levich & C.G. Wihlborg (eds.), *Research in International Business and Finance*, vol. 3, JAI Press Inc., Greenwich, CT., p. 3-27.

EC (1990), *One Market, One Money*, European Economy, no. 44, Brussels.

Fama, Eugene F. (1984), Forward and Spot Exchange Rates, *Journal of Monetary Economics*, vol. 14, p. 319-338.

Feldman, Robert A. (1986), *Japanese Financial Markets, Deficits, Dilemmas and Deregulation*, MIT Press, Cambridge MA.

Feldstein, Martin and Charles Horioka (1980), Domestic Saving and International Capital Flows, *The Economic Journal*, vol. 90.

Folkerts-Landau, D. (1989), The Internationalization of Financial Markets and the Regulatory Response, in: H. Vosgerau (ed.), *New Institutional Arrangements for the World Economy*, Springer Verlag, Berlin.

Frankel, J.A. (1986), International Capital Mobility and Crowding-out in the U.S. Economy: Imperfect Integration of Financial Markets or of Good Markets?, in: R.W. Hafer (ed.), *How open is the U.S. Economy?*, Lexington Books, Massachusetts.

Frankel, J.A. (1988), Recent estimates of time-variation in the conditional variance and in the exchange risk premium, *Journal of International Money and Finance*, vol. 7, p. 115-125.

Frankel, Jeffrey A. (1989), Quantifying International Capital Mobility in the 1980s, *NBER Working Papers*, nr. 2856.

Frankel, J.A. and K.A. Froot (1990), Chartists, Fundamentalists, and Trading in the Foreign Exchange Market, *American Economic Review*, vol. 80, p. 181-185.

Frenkel, Jacob A. and Richard M. Levich (1981), Covered interest arbitrage in the 1970's, *Economic Letters*, vol. 8, p.267-274.

G10 (1993), *International Capital Movements and Foreign Exchange Markets*, Report to the Ministers and Governors by the Group of Deputies.

Gemert, H.G. van and A.P.D. Gruijters (1992), Internationale Financiële Integratie: Achtergronden, Verschijningsvormen en Gevolgen, (International Financial Integration: Aspects and Consequences), *Rotterdamse Monetaire Studies*, vol. 11, no. 2.

Giavazzi, Francesco and Marco Pagano (1988), Capital Controls and the European Monetary System, in: Fair, D.E. and C. de Boissieu, *International Monetary and Financial Integration - The European Dimension*, Kluwer, Dordrecht.

Giovannini, Alberto (1989), How do Fixed-Exchange Rate Regimes Work? Evidence from the Gold Standard, Bretton Woods and the EMS, in: M. Miller, B. Eichengreen and R. Portes, *Blueprints for Exchange Rate Managment*, Academic Press, London, p. 13-46.

Goldstein, Morris, Donald Mathieson and Timothy Lane (1991), Determinants and Systematic Consequences of International Capital Flows, *IMF Occasional Papers*, no. 77.

Golub, Stephen S. (1990), International capital mobility: net versus gross stocks and flows, *Journal of International Money and Finance*, p. 424-439.

Grauwe, Paul de (1992), Inflation Convergence during the Transition to EMU, *CEPR Discussion Paper*, no. 658.

Gros, Daniel and Niels Thygesen (1992), *European Monetary Integration, From the European Monetary System to European Monetary Union*, Longman, London.

Hodrick, R.J. (1987), *The empirical evidence on the efficiency of forward and futures foreign exchange markets*, Harwood Academic Publishers, Paris.

Ito, Takatoshi (1986), Capital controls and covered interest parity between the Yen and the Dollar, *The Economic Studies Quarterly*, vol. 37, no. 3, p. 223-241.

Ito, T. (1990), Foreign exchange rate expectations: micro survey data, *American Economic Review*, vol. 80, p. 434-449.

Jager, H. (1991), The Global Exchange Rate System in Transition, *De Economist*, vol. 139, no. 4, p. 471-495.

Kasman, Bruce and Charles Pigott (1988), Interest Rate Divergences among the Major Industrial Nations, Federal Reserve Bank of New York, *Quaterly Review*, volume 13, no. 3.

Kenen, Peter B. (1976), Capital Mobility and Financial Integration: A Survey, *Princeton Studies in International Finance*, no. 39.

Keynes, John Maynard (1924), *A Tract on Monetary Reform*, London.

Koedijk, K.G. and M. Ott (1987), Risk aversion, efficient markets and the forward exchange rate, *Review Federal Reserve Bank of St. Louis*, vol. 69, no. 10, p. 3-13.

Lamfalussy, Alexandre (1981), Changing Attitudes towards Capital Movements, in: F. Cairncross (ed.), *Changing Perceptions of Economic Policy - Essays in honor of the seventieth birthday of Sir Alex Cairncross*, London.

Lemmen, J.J.G and S.C.W. Eijffinger (1993), The Degree of Financial Integration in the European Community, *De Economist*, vol. 141, no. 2, p. 189-213.

McCormick, Frank (1979), Covered Interest Arbitrage: Unexploited Profits? Comment, *Journal of Political Economy*, vol. 87, p. 411-417.

OECD (1990), *Liberalisation of Capital Movements and Financial Services in the OECD Area*, Paris.

Oxelheim, Lars (1990), *International Financial Integration*, Springer Verlag, Berlin etc.

Ricardo, David (1817), *The principles of political economy and taxation*, chapter 7 on foreign trade, edition J.M. Dent & Sons, London 1933.

Turner, Philip (1991), Capital Flows in the 1980s: A Survey of Major Trends, *BIS Economic Papers*, no. 30.

Vliegenthart, Bas (1993), EMU and Investment Funds, in: S.C.W. Eijffinger and J.L. Gerards (eds.), *European Monetary Integration and the Financial Sector*, NIBE, Amsterdam.

Watson, Maxwell et al (1988), Innovations and Institutional Changes in Major Financial Markets, A Ten year Perspective, *IMF World Economic and Financial Surveys*, January, p. 35-49.

Wihlborg, Clas (1982), The Effectiveness of Exchange Controls on Financial Capital Flows: A Framework for Analysis, *Columbia Journal of World Business*, Winter, p. 3-10.

IN 1993 REEDS VERSCHENEN

588 Rob de Groof and Martin van Tuijl
The Twin-Debt Problem in an Interdependent World
Communicated by Prof.dr. Th. van de Klundert

589 Harry H. Tigelaar
A useful fourth moment matrix of a random vector
Communicated by Prof.dr. B.B. van der Genugten

590 Niels G. Noorderhaven
Trust and transactions; transaction cost analysis with a differential behavioral assumption
Communicated by Prof.dr. S.W. Douma

591 Henk Roest and Kitty Koelemeijer
Framing perceived service quality and related constructs A multilevel approach
Communicated by Prof.dr. Th.M.M. Verhallen

592 Jacob C. Engwerda
The Square Indefinite LQ-Problem: Existence of a Unique Solution
Communicated by Prof.dr. J. Schumacher

593 Jacob C. Engwerda
Output Deadbeat Control of Discrete-Time Multivariable Systems
Communicated by Prof.dr. J. Schumacher

594 Chris Veld and Adri Verboven
An Empirical Analysis of Warrant Prices versus Long Term Call Option Prices
Communicated by Prof.dr. P.W. Moerland

595 A.A. Jeunink en M.R. Kabir
De relatie tussen aandeelhoudersstructuur en beschermingsconstructies
Communicated by Prof.dr. P.W. Moerland

596 M.J. Coster and W.H. Haemers
Quasi-symmetric designs related to the triangular graph
Communicated by Prof.dr. M.H.C. Paardekooper

597 Noud Gruijters
De liberalisering van het internationale kapitaalverkeer in historisch-institutioneel perspectief
Communicated by Dr. H.G. van Gemert

598 John Görtzen en Remco Zwetheul
Weekend-effect en dag-van-de-week-effect op de Amsterdamse effectenbeurs?
Communicated by Prof.dr. P.W. Moerland

599 Philip Hans Franses and H. Peter Boswijk
Temporal aggregration in a periodically integrated autoregressive process
Communicated by Prof.dr. Th.E. Nijman

600 René Peeters
On the p-ranks of Latin Square Graphs
Communicated by Prof.dr. M.H.C. Paardekooper

601 Peter E.M. Borm, Ricardo Cao, Ignacio García-Jurado
Maximum Likelihood Equilibria of Random Games
Communicated by Prof.dr. B.B. van der Genugten

602 Prof.dr. Robert Bannink
Size and timing of profits for insurance companies. Cost assignment for products with multiple deliveries.
Communicated by Prof.dr. W. van Hulst

603 M.J. Coster
An Algorithm on Addition Chains with Restricted Memory
Communicated by Prof.dr. M.H.C. Paardekooper

604 Ton Geerts
Coordinate-free interpretations of the optimal costs for LQ-problems subject to implicit systems
Communicated by Prof.dr. J.M. Schumacher

605 B.B. van der Genugten
Beat the Dealer in Holland Casino's Black Jack
Communicated by Dr. P.E.M. Borm

606 Gert Nieuwenhuis
Uniform Limit Theorems for Marked Point Processes
Communicated by Dr. M.R. Jaïbi

607 Dr. G.P.L. van Roij
Effectisering op internationale financiële markten en enkele gevolgen voor banken
Communicated by Prof.dr. J. Sijben

608 R.A.M.G. Joosten, A.J.J. Talman
A simplicial variable dimension restart algorithm to find economic equilibria on the unit simplex using $n(n+1)$ rays
Communicated by Prof.Dr. P.H.M. Ruys

609 Dr. A.J.W. van de Gevel
The Elimination of Technical Barriers to Trade in the European Community
Communicated by Prof.dr. H. Huizinga

610 Dr. A.J.W. van de Gevel
Effective Protection: a Survey
Communicated by Prof.dr. H. Huizinga

611 Jan van der Leeuw
First order conditions for the maximum likelihood estimation of an exact ARMA model
Communicated by Prof.dr. B.B. van der Genugten

612 Tom P. Faith
Bertrand-Edgeworth Competition with Sequential Capacity Choice
Communicated by Prof.Dr. S.W. Douma

613 Ton Geerts
The algebraic Riccati equation and singular optimal control: The discrete-time case
Communicated by Prof.dr. J.M. Schumacher

614 Ton Geerts
Output consistency and weak output consistency for continuous-time implicit systems
Communicated by Prof.dr. J.M. Schumacher

615 Stef Tijs, Gert-Jan Otten
Compromise Values in Cooperative Game Theory
Communicated by Dr. P.E.M. Borm

616 Dr. Pieter J.F.G. Meulendijks and Prof.Dr. Dick B.J. Schouten
Exchange Rates and the European Business Cycle: an application of a 'quasi-empirical' two-country model
Communicated by Prof.Dr. A.H.J.J. Kolnaar

617 Niels G. Noorderhaven
The argumentational texture of transaction cost economics
Communicated by Prof.Dr. S.W. Douma

618 Dr. M.R. Jaïbi
Frequent Sampling in Discrete Choice
Communicated by Dr. M.H. ten Raa

619 Dr. M.R. Jaïbi
A Qualification of the Dependence in the Generalized Extreme Value Choice Model
Communicated by Dr. M.H. ten Raa

620 J.J.A. Moors, V.M.J. Coenen, R.M.J. Heuts
Limiting distributions of moment- and quantile-based measures for skewness and kurtosis
Communicated by Prof.Dr. B.B. van der Genugten

621 Job de Haan, Jos Benders, David Bennett
Symbiotic approaches to work and technology
Communicated by Prof.dr. S.W. Douma

622 René Peeters
Orthogonal representations over finite fields and the chromatic number of graphs
Communicated by Dr.ir. W.H. Haemers

623 W.H. Haemers, E. Spence
Graphs Cospectral with Distance-Regular Graphs
Communicated by Prof.dr. M.H.C. Paardekooper

624 Bas van Aarle
The target zone model and its applicability to the recent EMS crisis
Communicated by Prof.dr. H. Huizinga

625 René Peeters
Strongly regular graphs that are locally a disjoint union of hexagons
Communicated by Dr.ir. W.H. Haemers

626 René Peeters
Uniqueness of strongly regular graphs having minimal p-rank
Communicated by Dr.ir. W.H. Haemers

627 Freek Aertsen, Jos Benders
Tricks and Trucks: Ten years of organizational renewal at DAF?
Communicated by Prof.dr. S.W. Douma

628 Jan de Klein, Jacques Roemen
Optimal Delivery Strategies for Heterogeneous Groups of Porkers
Communicated by Prof.dr. F.A. van der Duyn Schouten

629 Imma Curiel, Herbert Hamers, Jos Potters, Stef Tijs
The equal gain splitting rule for sequencing situations and the general nucleolus
Communicated by Dr. P.E.M. Borm

630 A.L. Hempenius
Een statische theorie van de keuze van bankrekening
Communicated by Prof.Dr.Ir. A. Kapteyn

631 Cok Vrooman, Piet van Wijngaarden, Frans van den Heuvel
Prevention in Social Security: Theory and Policy Consequences
Communicated by Prof.Dr. A. Kolnaar

IN 1994 REEDS VERSCHENEN

632 B.B. van der Genugten
Identification, estimating and testing in the restricted linear model
Communicated by Dr. A.H.O. van Soest

633 George W.J. Hendrikse
Screening, Competition and (De)Centralization
Communicated by Prof.dr. S.W. Douma

634 A.J.T.M. Weeren, J.M. Schumacher, and J.C. Engwerda
Asymptotic Analysis of Nash Equilibria in Nonzero-sum Linear-Quadratic Differential Games. The Two-Player case.
Communicated by Prof.dr. S.H. Tijs

635 M.J. Coster
Quadratic forms in Design Theory
Communicated by Dr.ir. W.H. Haemers

636 Drs. Erwin van der Krabben, Prof.dr. Jan G. Lambooy
An institutional economic approach to land and property markets - urban dynamics and institutional change
Communicated by Dr. F.W.M. Boekema

637 Bas van Aarle
Currency substitution and currency controls: the Polish experience of 1990.
Communicated by Prof.dr. H. Huizinga

638 J. Bell
Joint Ventures en Ondernemerschap: Interpreneurship
Communicated by Prof.dr. S.W. Douma

639 Frans de Roon and Chris Veld
Put-call parities and the value of early exercise for put options on a performance index
Communicated by Prof.dr. Th.E. Nijman

640 Willem J.H. Van Groenendaal
Assessing demand when introducing a new fuel: natural gas on Java
Communicated by Prof.dr. J.P.C. Kleijnen